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MAGSAT PROGRAM

E82-100 06

CR-164904

Progress Report No. 3

Investigation Number M-41

RECEIVED

AUG 25, 1981

SIS/902.6

M-041

TYPE II

THE REDUCTION, VERIFICATION AND INTERPRETATION

OF MAGSAT MAGNETIC DATA OVER CANADA

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(E82-10006) THE REDUCTION, VERIFICATION AND
INTERPRETATION OF MAGSAT MAGNETIC DATA OVER
CANADA Progress Report (Energy Information
Administration) 3 p HC A02/MF A01 CSCI 05B

N82-15484

Unclass

G3/43 00006

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July 1981

I INTRODUCTION

This investigation is primarily concerned with studies of the magnetic field originating in the solid earth, as measured by Magsat. Most of this field originates in the core, but an important part is of lithospheric origin. Magnetic anomalies of lithospheric origin are weak at Magsat altitudes (20 to 30 nT at most), and they are easily masked by much larger effects caused by field-aligned and other currents at high latitudes. Most of Canada lies under the influence of ionospheric currents in the auroral zone and polar cap.

A more refined selection of quiet Magsat data has allowed a revised scalar magnetic anomaly map of the whole region north of about 40°N latitude. Very preliminary vector anomaly maps and absolute vector component maps have been derived.

II TECHNIQUES

The basic techniques have been described in earlier reports. No distinctly new techniques have been developed during this reporting period.

III ACCOMPLISHMENTS

All the CHRONINT intermediate attitude tapes, with the exception of three isolated tapes which arrived much later, were processed and decimated to provide a basis for producing the scalar total force chart and scalar anomaly maps to be presented at the Edinburgh workshop and the 1981 IAGA Symposium. The scalar field was derived from the vector component values from 199 selected quiet passes.

There seems to be a problem with these scalar magnitudes for the latter part of the mission, after mid-April 1980. Selected passes (on the basis of low Kp and low activity at Canadian observatories) have large residual anomalies, uncorrelated from pass to pass, even when the magnetograms are flat. This is only an observation, and has not yet been thoroughly investigated. Therefore no data past mid-April were used in the maps.

Processing of CHRONFIN fine-attitude tapes was started, in the absence of Investigator tapes, but recent acquisition (early July) of the first readable Investigator tapes has permitted a frenzied period of processing of vector data from the first 2½ months of Magsat.

The technique for removing quadratic functions from data on individual passes was extended so that an independent quadratic function is fitted to each of the scalar and 3 vector components for each pass. There is no link between the functions by way of consistency checks at this time.

A selection of 85 passes during these first 2½ months of data was made on the basis of the earlier 'quiet' pass selection from the CHRONINT tapes. These have been used to produce the first attempts at vector maps over the north polar region (north of 40°N). Examination of individual passes shows severe external field problems, as expected, in X and Y components. These preliminary maps are too new to be included in this report, although they will be shown in the Investigators workshop in Edinburgh.

Results from processing the scalar data derived from the CHRONFIN tapes indicated that there were problems with the field model MGST 4/81-2. The residuals relative to that model were in general larger than those relative to the first field model MGST 3/80. Work with the Investigator tapes has confirmed this, for the early part of the data set.

IV SIGNIFICANT RESULTS

The scalar magnitudes show great promise for mapping the total force and anomaly fields. The Z vector data also appear to be good. The horizontal X and Y vector data are seriously contaminated with external fields and maybe other effects.

V PUBLICATIONS

Two papers as listed in Report No. 2 (March 1981) will be presented at IAGA 1981.

VI & VII PROBLEMS AND DATA DELIVERY

A computer program was devised here to read the IBM-binary NASA Investigator tapes on our CDC Cyber machine. This involves complicated bit conversion routines, and worked properly on the test tape supplied by NASA. The first production Investigator tapes, received in late March, could not be read on this system, having been incorrectly written. The long delay in receiving the replacement correctly-written tapes has meant that our work with the vector data is not as advanced as was hoped for. Because there are so few adequately quiet passes, the full span of data over the Magsat lifetime is needed before good maps and charts can be produced.

VIII RECOMMENDATIONS

Send out the Investigator tapes.

IX CONCLUSIONS

Although the scalar and vertical component absolute data and residuals can provide useful charts and maps, the vector horizontal measurements may not be usable in this way. Certainly, far fewer complete polar passes are acceptably quiet in the horizontal components, although it may be possible to use parts of passes.